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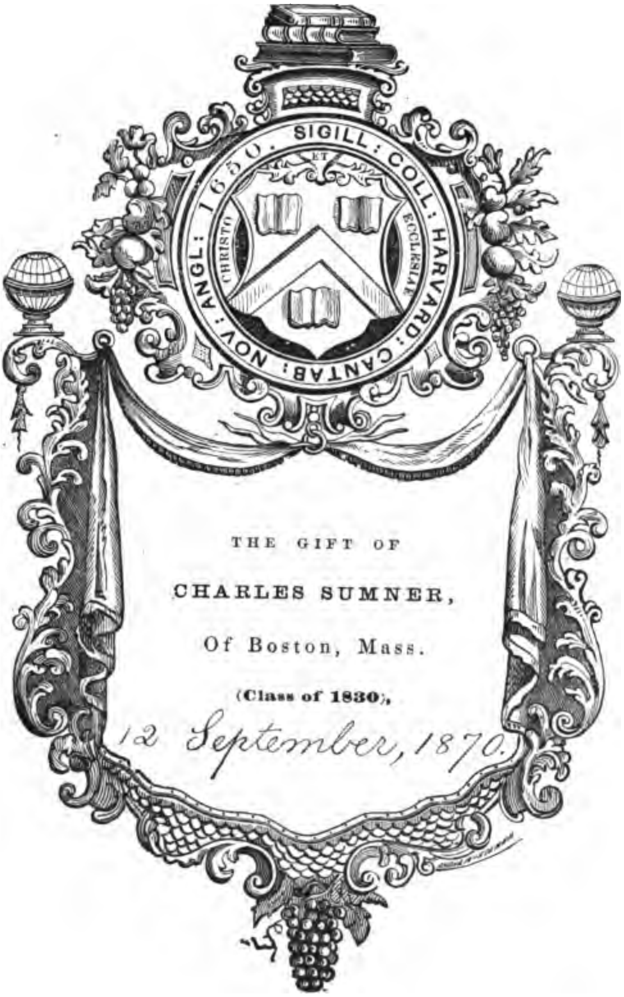
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C. S. SCHÜZENBACH'S

NEW METHOD

OF

MAKING SUGAR.

with the compliments of
George T. Chapman

New York:
THE "SEASON" PRESS, 39 VESEY STREET.
1870.

making no molasses, and producing chemically pure sugar at the first operation.

It is now proposed to form a company for the purpose of raising sugar beets, and manufacturing them into marketable sugar, of a quality far superior to raw cane sugars. The enterprise will be initiated and controlled by men of high commercial standing, whose names are familiar to the whole community, and are guarantees of the sound principles upon which it will be carried on. The beet culture will be of especial advantage to farmers, who will find it very profitable to raise beets for sale to the sugar factories, and who can fatten their cattle on the nutritious pulps; to railways, whose traffic will be increased wherever the culture is established; to sugar refiners, who can use the dried beets in their business, instead of raw sugar, by adding the new apparatus to their present machinery; and to the public at large, which forms the grand body of consumers, whose sugar will be provided for them in a few years at less than one-half the rates now prevailing.

TRANSLATION OF

Schüzenbach's Pamphlet.

In the works which I undertook during the last few years, with the end in view of improving and simplifying the art of manufacturing sugar from beets, I made it my special object to discover means whereby not merely the same results, but a great diminution of the cost thereof might be attained, while proceeding in the same manner with thousands of tons of material as I did formerly in analyzing small quantities. The method adopted by me is acknowledged by scientific men to be the surest and most reliable, viz: drying the beets and extracting the sugar from them by means of alcohol.

With regard to the advantages of this mode of extracting the saccharine matter from the beet-roots, I refer to the official report presented to the British Parliament by a committee appointed to investigate the subject, and of which a translated copy is to be found in a former number of "The Journal of the Beet Sugar Trade in the German Zollverein."

As is well known, I am the originator of the process of making sugar from dried beets. The same has been in operation for the past quarter of a century, with more or less satisfactory results.

My original design was to use alcohol for extracting the sugar from the dried beets ; this was done with success while applied to limited quantities of beets, but when undertaken on a larger scale, difficulties occurred which at that time could not be overcome, as technical means to remove them had first to be sought for and found, which could not then be done for various reasons. Of the nature of these obstacles the "Traite de Chimié Applique aux Arts," by M. Dumas, published about twenty years ago, will give an explanation, which, though correct in some respects, is not strictly so in all its relations. These difficulties made it temporarily impossible for me to prosecute the work in the only rational way, that originally adopted ; they threw me back again upon the process then and now still in use, and compelled me to employ water, with a large addition of lime, instead of alcohol, as the extracting agent. This compulsory shift, although it left much to be wished for, was still sufficient to effect results which gave to those factories working but partially by this process, being at that time very few, a decided advantage over those conducted on the old system, and still enables them at the present time to compete with the latter effectively, notwithstanding the improvements which have been made in the old mode of working.

The fact that several factories have discontinued the drying process proves nothing against it. There never was a manufacturing process which may not, under certain circumstances and conditions, appear to be less advantageous than another, or which can prove profitable with a careless and unwise application.

The number of sugar factories using the drying system is, and always has been, small ; it has not extended any further because neither myself nor others took any pains to extend it ; consequently the system lacked defenders ; whereas the number of opponents was large, and their victory, therefore, easy and undisputed, which, even now, twenty years later, does not hinder a few persons from applying the ass's kick whenever they can get an opportunity to ventilate their pretended wise judgment, their admirable sagacity, and their deep founded knowledge. But the real merit of the treatment by drying the beets is conclusively shown by the fact that many factories have returned to the maceration process. I mention all these circumstances particularly, only for the reason of my anxiety to make it clearly appear to every one that in the search for new remedies to improve and simplify the drying process, I have by no means placed myself upon a new and unknown basis, but upon one which, having founded myself, is therefore thoroughly known to me, and of which I am incontrovertably certain that it is the only one whereby we can produce sugar at the very lowest price.

To attain these projected simplifications and improvements in the drying process, and the manufacture of sugar, I had to solve the following problems, viz.:

1. The ways and means of drying the beets with the least possible expense, and without deleteriously effecting their contents of crystalizable sugar.
2. The transformation of the beets, with the least possible expense, and without loss of material, by using proper machinery, into grains of such size that their contents of sugar can be easily and completely extracted with alcohol.
3. To construct an apparatus which is hermetically closed, and so constructed that the extraction of the sugar with alcohol, and the subsequent expulsion of the alcohol by steam, can take place, without exposing the latter to contact with the air, and thus completely prevent its evaporation and loss.
4. To construct an apparatus in which it is made possible to separate the alcohol used in extracting from the extract, without injury to the crystalizable sugar, and to reobtain it, *i. e.* the alcohol, without any loss of its original strength; that is, as it is continually applied during the process.

I have gradually succeeded in solving all these problems most satisfactorily, and have attained—

1. To drying the beets, without the least injury to the contents of crystalizable sugar, and with the least possible expense.
2. To transform the beets, by means of a very simple and substantial machine, and with hardly any expense, into grains.
3. To prepare these grains so that the extraction of their saccharine contents can be undertaken with the least possible quantum of alcohol.
4. To construct an extremely proper and substantial apparatus of copper and iron, hermetically closed, wherein the extraction of the sugar by alcohol, and the expulsion of the latter by steam, proceeds in such a manner that neither a trace of alcohol or of sugar remains in the pulps, nor can any loss of these two take place during the extraction and expulsion of the alcohol; and, lastly,

5. To construct an apparatus wherewith it is made possible to regain with only a trifling expense of fuel, the alcohol used for extracting without any loss of the same, and in its original condition, so that it can immediately be re-used for further extraction. By these inventions, the manufacture of sugar from beets, or other saccharine substances equally easy to be dried, will have attained the highest degree of simplicity and security of which it is capable.

The drying of the beets, and their transformation into grains, are not necessarily closely connected with the proper sugar manufacturing, and therefore can be conducted separately.

After the drying and cutting, the work then to be performed is confined,

1. To the preparation of the grains for extraction.
2. To the extraction of the sugar, and the expulsion of the alcohol, both taking place simultaneously, in one and the same apparatus.
3. To the distillation of the alcohol from the extract.

These few simple performances, requiring but very little hand labor, are sufficient to arrive from the grains to the alcoholic freed extract, which latter is entirely free of slime and almost colorless, weighing when cold from 35-37 deg. Be., and equal in saccharine quality to a solution of raw sugar of like specific weight.

If it is further desired to work this extract into candies, refinate, fine melis, etc., it must be subjected to the very same treatment which solutions of good raw sugar are now commonly subjected in refineries. But if we desire to confine ourselves only to the production of pure white powder sugar, which is equal to so-called refined, it will be sufficient to filtrate the extract, the same as a solution of good raw sugar, only *once* through bone-black, and then continue the process further in the usual manner.

It is obvious, that the application of such a simple process of manufacturing, consisting only of such few arrangements, does not require as much space, nor so many machines and utensils, as the old and complicated system now in use.

In this new system of mine, the following arrangements, machineries and utensils only are required :

1. An establishment for drying and cutting the beets.
2. A magazine for preserving them when dried.
3. A separate room or building to prepare the grains for the extraction of the sugar from them, and for separating the alcohol from the extract.
4. A building provided with the usual arrangements, of candis, and other stuffs, sugar receivers, &c., in proportion to the amount of business to be prosecuted.

If a more than medium sized factory is to be constructed on this new system, say, working 200,000 cwts.,(10,000 tons) of green beets per year, and producing therefrom about 20,000 cwts., (1000 tons) pure or refined sugar, the following investment of capital will be required for buildings and arrangements :

I.

Drying Establishment.

For the building in which the drying ovens are erected, with the necessary machinery,	6000	Pruss. Thalers.	
For 25 drying ovens at 400 Th.	10.000	" "	
All other necessary machinery	4,000	" "	
Total,	20,000	Pruss. Thalers, or	$14,000

II.

Magazine for preserving the dried beets,	4.000	Pruss. Thalers, or	$2,800

III.

Extracting and Separating Division.

For a separate stone building,	3,000	Pruss. Thalers, or	$2,100
For all the machinery, apparatuses and utensels, necessary to prepare the grains, extract the sugar, and destilling the alcohol from the extract,	9,000	Pruss. Thalers, or	$6,300
	12,000	Pruss. Thalers, or	$8,400
Total.	36,000	Pruss. Thalers, or	$25,200

To this sum of 36,000 Thalers, there is further to be added the sum, which will be required for the erection and usual arrangements of a small refinery, where 60-70 cwts. daily, or about 20,000 cwts. (1,000 tons) yearly are produced. I here mention, that in making the above estimate of costs for the buildings, I have based the same, on account of the diversity of prices in different sections of the country, on average cost of building materials for the whole German Zollverein.

A Factory constructed and arranged on the old system, capable of producing 20,000 cwts. (1,000 tons) annually of refined sugar from green beets, cannot, as it is well known, be established for less than about 200,000 Thalers, ($140,000).

The relative difference between the cost of the new and the old system is very great ; that of the latter being four times as large as that required in the construction of a factory on the new plan, of the same producing capacity. Much less will however be required to alter an existing factory of the old system, and adapt it to the new. In this case the outlay is confined to the erection and arrangement of the establishment for drying and cutting the beets. For all the other requirements, the old arrangements, of which there are not so many needed in the new process, can by small alterations, be made just as servicable as entirely new ones, and the expenses of these alterations can be covered by the proceeds to be realized from the sale of those machineries, apparatuses and utensils which are no longer wanted, even if they be sold for old metal. This step will however not be necessary with all of them.

By adopting the new system the following will be placed among the superfluities :

(*a.*) The greatest part of the boilers.

(*b.*) A large part of the machine power.

(*c.*) All presses and rasps, and whatever belongs to them.

(*d.*) All separating pans.

(*e.*) The apparatus for generating carbonic acid-gas, and everything connected with it.

(*f.*) A large part of the charcoal filters.

(*g.*) All apparatuses or pans for evaporating and concentrating the juice, from 35-37 degs. Bl.

(*h.*) The centrifugals for which there will be no further use whatever.

(*i.*) All the cisterns and nearly all the reservoirs, in which the syrups weakened by preceding crystalization are crystalized.

(*j.*) The largest part of the space and arrangements which are now required in the restoration of the boneblack, and which is not applied any further, but is soiled, with slime, lime, &c., as it occurs at present in such refineries where good raw sugar is exclusively consumed, &c.

It need not be mentioned, that with all these machineries and utensils, the hand labor required in their attendance is also done away with, and that thereby a great saving will be accomplished.

Even if these machineries, apparatuses and utensils named above, in consequence of not having any further use for them, at least in the same manner and combination as heretofore, do suffer a great diminution in value, yet the loss is not so great after all as it might appear at first view. This will be perceived from the following:

The machineries, boilers, filters, &c. which become superfluous, can be retained, in proportion to the increase of business, which will be resolved upon by many.

Many parts of the former fixtures on hand can be again used with advantage in constructing the new arrangements. The rasps, presses, centrifugals, &c., can also again be adtageously used in other factories, thus commanding a better price than if sold for old metal; and lastly, the space not required by the new system, can be altered and made available for other purposes.

I shall now proceed to place the costs and results of the manufacturing process in general use up to the present time in comparison with those of the new system.

It is a fact, that, in the Prussian province of Saxony not only the state of the beet culture is favorable to the manufacture of sugar, but it is also, on an average better conducted and managed. There, in the best regulated factories, 9 *per cent.* of raw sugar of the 1st, 2d, 3d and 4th crystalization is gained from beets containing from 12 to 12¼ per cent. of pure sugar. The average quality of this per centage gained is such that in refining, it only loses 12 *per cent.* in weight. The cost of producing the raw sugar, not including the tax, is 2⅙ thalers, or $1.52 in average per cwt.

The reduction of 12 *per cent.* in weight, just referred to is mainly chargeable to the water, slime, and salt in the raw sugar ; but it reduces the gain of 9 per cent. from the latter, to 8 per cent.; thus from the original 12 *to* 12½ *per cent.* contained in the beets, only 8 per cent. is finally gained. From this it follows, that even in the most favorable case, by the manipulation of the old system fully a third of the saccharine contents of the beets are lost.

In working the beets after the new process, the loss of the sugar contained in the same is hardly as much, but positively does not exceed the loss sustained in refining good raw sugar; therefore only 8-9 part of the original-sugar contents of the beets. Consequently from beets containing from 12-12½ per cent. of sugar, 10½ per cent. of pure sugar is obtained ; and as the proportionate relation of 8 to 10½ is the same as of 100 to 131⅛, fully 30 per cent. more is obtained than in the old process. The cost of manufacturing with presses, &c. by the old process is known to every manufacturer or proprietor from self-experience ; I therefore deem it superfluous to enter into details regarding it, and here only confine myself to the positive declaration, that, without considering the important diminution of the tax brought about by the additional increase gained in sugar by the proper application of the new process, the cost of manufacturing an equally large quantity of beets of the same quality (calculated from the raw beets to the completely refined sugar in both cases) is much less than by the most improved application of the old system.

Here I mention most particularly that in the foregoing statement concerning the costs of the new process, I have included all and every expense, inclusive of drying and cutting the beets, loss of alcohol, (this estimated at the highest price) etc.

This applies to beets yielding 12 or more per cent. of pure sugar. But, on an average, there are few sections of the country where such rich beets are produced, and it occurs very often that they contain only 9 to 10 per cent. of sugar, or even less.

Under the old system it is well known that the cost of working the beets increases in proportion as the latter are poorer in sugar. If they are poor in sugar, or if they have suffered in the least through the manner of preservation, or in any other way, they very often cannot be converted into sugar without loss. In such a case the comparison of costs and results between the new and the old processes will be greatly in favor of the former as will be explained in the following statements:

The beets yield less dried substance exactly in proportion to their deficiency in sugar, and it may happen that instead of 5 cwt. it may require 6½ cwt. of green beets to produce 1 cwt. of dried substance. In this case an increase of the expense of drying surely takes place, but, simultaneously, a much greater reduction in the amount of tax to be paid, because this—in working dried beets—is not levied upon the quantity of green beets used, but upon the dried substance, *i.e.*, not upon the 6½ cwt., but upon the 5 cwt.

It is to be particularly noticed that the dried substance always contains the same proportion of pure sugar, viz.: from 64 to 68 per cent., no matter whether it is obtained from rich or poor beets, if the latter condition has not been caused by not having been properly preserved before, during or after drying, an error which can be easily avoided. These 64 to 68 per cent. of pure sugar contained in the properly dried substance suffer, as already explained, a diminution of from 10 to 12 per cent. in refining, finally yielding 57 to 60 per cent. of pure or so-called refined sugar.

Whoever in reality doubts that the dried substance of the beet contains that much pure sugar, and who may find it inconvenient or may be otherwise prevented from drying a small quantity of his own beets in an oven and then carefully analysing it, I refer him to the official report of the British Parliamentary Committee mentioned in the beginning of this pamphlet. Every manufacturer who was by circumstances compelled to work with poor beets (which I consider to be those containing from 9 to 10 per cent. only) knows from personal experience that under the old system it is only with increased expenditures and considerable pains and attention that he succeeds in obtaining an average of 5 to 6 per cent. of good refined sugar, while others who use only rich sugar beets obtained 8 per cent. at much less cost and trouble and did a lucrative business. This great obstacle to success will certainly be removed by the adoption of the new system. The manufacturer who works beets having 9 to 10 per cent. or even less per centage of sugar will by the new method obtain from his beets, instead of only 5 to 6 per cent., at least 8 to 9 per cent., that is not less than 40 to 50 per cent. more than formerly, he will thus, with the small increase in expenses of a few cents per cwt. for drying, obtain perfectly good refined sugar at the same cost as the one who uses richer beets, therefore the great advantage which his competitor now has over him will not be perceptibly felt any longer.

The greatest evil because based on an injustice, from which at present a good many of the sugar manufacturers suffer is the equal taxation of beets whether rich or poor in sugar, so sometimes the one has to pay 50 per cent. more taxes for his refined sugar than another. By using dried beets and paying the tax on them, and not on the green beets this great evil is removed.

Another great advantage of the new system is, that secondary and without the least detriment to the production of sugar, all the other useful ingredients of the beets are obtained unchainged and undiminished which by the old plan are in great part lost. How important this advantage is, in itself and in its consequences to agriculture I will explain subsequently. I have already shown, that, in comparison with the old system, in working poor sugar beets containing 10 per cent. or less of saccharine matter, the new process offers greater advantages than in working rich beets. I therefore purposely choose the latter case as the more unfavorable to put forth clearly by a simple arithmetical example how large the gain is which is guaranteed to the manufacturer. There may be, in the province of Saxony, and in the adjoining countries of Germany, where the beet culture and its manufacture into sugar under the old system has improved the most, a few factories which gain from beets whose average contents are 14 or more per cent. of sugar, from 9-10 per cent, of raw sugar, which is, taking the 1st, 2d, 3d and 4th product together, on an average of such excellent quality that in refining, it loses not more than 12 per cent. in weight.

Let us assume as an illustration, that one of these manufactories on the old plan, that is with rasps, presses, &c, works up in a year 200,000 cwts, or 10,000 tons of green beets containing from 12 to 13 per cent. of sugar ; extracts therefrom 9 per cent. of good raw sugar, and sells its excellent product at 11 Prussian Thalers, ($7.70) per cwt. at a time when the *candis*, finest *melis*, &c., can be easily sold at 14 Pruss Thalers, ($9.80) so that the refiner, if necessary, and without apparent loss can pay this price, it will receive for its 18,000 cwts. of raw sugar 198,000 Pruss. Thalers, ($138,600). Supposing now, that another manufacturer working on the new plan, uses the same quantity of similar beets, the latter will as explained above, produce 11 instead of 9 per cent. of raw sugar, gaining from the 200,000 cwts. of beets, 22,000 cwts. of candis, finest melis, &c. ; consequently he will realize, at the same price as in the first case named, 308,000 Pruss. Thalers, ($215,600,) an excess of 110,000 Thalers, or $77, 000 ; which is 55 per cent. more than received by the first, and at the same time the whole expenses of producing are less, which makes the business a brilliant one.

As I have already shown that by working poor beets, after the new system, a far more favorable result is obtained, I therefore deem it unnecessary to exemplify it by figures. Not less favorable does the new system prove for the refiner, who resolves upon using dried beets instead of good raw sugar, in his factory.

One hundred and fifty lbs. of beet grain contain as much pure sugar as *one hundred lbs.* of good raw sugar, the loss of 12 per cent. in refining the latter, making it equivalent in quality to the former.

The reduction of the granulated beets to refined sugar, though requiring the erection of a separate building, wherein to conduct the extraction and re-extraction of the alcohol, and costing 12-15 Sgr., (30-35 cts.) more per cwt. of the perfectly refined sugar, is otherwise however, just as sure, simple and pure as the latter.

For example, a Refiner uses 100,000 cwts. (5,000 tons) annually of good raw sugar, costing him on an average, 11 thalers ($7.70) per cwt., the amount he will thus pay will be 1,000,000 thalers ($770,000. A cwt. of granulated beets, light and of best quality, can be procured, inclusive of the tax for 3½ thalers ($2.45) thus: For 150,000 cwts. of these, equivalent as before shown to 100,000 cwts. of excellent raw sugar, he will only pay $525,000 thalers ($367,500); consequently, after deducting the additional increase of 12—15 sqr. (30-35) mentioned in the preceding, in the cost of manufacturing it, saving the grand sum of 530,000 thalers ($371,000), which will give him a preponderance over his competitor, who only uses raw sugar. But above all the greatest gain is imparted by the introduction of the new system to the farmer, and through it, indirectly to the country itself; for it makes the manufacture of sugar just as accessable to him as to the manufacturer proper, which heretofore was not, and could not be the case, on account of the artificial and complicated construction of the old process.

For the farmer, as such, the nitrogenous substances and the salts are the most valuable ingredients of the beets. If he receives the first unchanged and undiminished he can feed his cattle with them in the best manner. After feeding his cattle, he will obtain them again as manure, including the salts, and return them to his fields, which will well pay him for all expenses of culture. If he can always again return to his lands what he has taken therefrom of fertilizing power, he can again and again cultivate beets, without fear of weakening its productive capacity, or that the beets, lacking the elements necessary for their prosperity, will degenerate or deteriorate. Without feed culture the farmer cannot well exist, and the most nutritious food is of the greatest value to him. This is offered to him by the new process, after the sugar has been extracted, which latter, as well known, does not form any blood, meat, etc., but serves only as a vehicle of digestion, for which purpose, however, the salts contained in the beets are in themselves alone more than sufficient. From this it is perceptible that the sugar contained in the beets costs the cultivator nothing, who cultivates them only in proportion to his requirements of feeding his cattle, and working them into sugar on the new plan.

The occupation of the farmer and his circumstances in general bring it with them, tnat he can only secondarily meddle with other matters, and then only with such as are simple and inexpensive, if he does not wish to injure himself. For this reason, he could not up to the present time occupy himself with manufacturing beet-root sugar; firstly, because its production requires many expensive arrangements, and an organized supervising and laboring attendance; secondly, the pulps returned to him were, by the application of the old manipulations, deprived of their most nutritous ingredients, and therefore offered him no full compensation for his labor. This is now changed. There are no complicated or expensive arrangements required any longer. A limited number of cheap, simple and substantial arrangements are now sufficient for him to obtain from the beets which he may cultivate for the use of his cattle, and before giving them to feed, pure white sugar, equal in quality to good melis. Proportionately similar with the arrangements required are also the supervising and working attendance. If, up to the present, his distiller was prompt and capable enough to properly distill whiskey of 80 degrees from corn and potatoes, after the old and long established treatment, he will just as easily comprehend and properly apply the few and very simple manipulations required in this new system, and, as there are no more tricks to be used, his laborers can be employed during the winter and bad weather, when prevented from working in the fields, in manufacturing sugar, which would be of great advantage to the farmer and his laborers.

The pulps remaining, by the new system, are incomparably more nutritious than the potatoe swills, and possess a much greater value as food for cattle. A rural sugar factory requires hardly as large, but in no instance a large, investment than a whiskey distillery. The sugar obtained from an equally large land surface is of more value, and easier disposed of, than spirits. If a farmer confines himself to the cultivation of beets required for feeding his cattle, the sugar contained in the beets, as already explained, will cost him nothing. The only expense incurred being confined to the tax and costs of management; the latter, everything included, not exceeding 2 thalers ($\$1\frac{54}{100}$) per cwt. of finished sugar, because he can furnish the labor, being his own, cheaper than the manufacturer. With the tax added, it will cost him about $4\frac{1}{4}$ thalers ($\$3\frac{15}{100}$), consequently, as long as he is able to dispose of it for export, at five thalers ($\$3\frac{50}{100}$), in which case the tax is refunded, and for domestic consumption, when the tax is not refunded, at $6\frac{1}{2}$ thalers ($\$4\frac{55}{100}$) per cwt., which is about the price of bread, he will do a good business, which is not often the case with distilleries.

The erection of a model factory of this kind, with free access to every farmer, would suffice to extend the new system of producing sugar all over the country within a few years.

The introduction of this new system will contribute powerfully to invigorate agriculture and enhance the value of land; it can, by exportation of its products, become a source of great wealth for the whole country, and finally, it will be a natural and particular domestic industry, which cannot any more be seriously endangered by foreign competition, and will reqnire no protective tariff. The reproach of being a parasitical institution, degenerated by excessive artificialities, fed and fostered at the expense of consumers, cannot in future be applied to it, although its application to the old system was not altogether undeserved.

I cannot omit the present opportunity of calling attention to the fact, that the many complicated and expensive utensils applied in the old process, and their manipulations, present a strange view and leave a peculiar impression, which I will not at present characterize. It is actually remarkable what is done there to destroy the nitrogenous substances, the most valuable next to sugar contained in the beets, and at the same time sacrificing a large part of the latter itself.

After the manufacturer has obtained the juice in a very wasteful manner from the beets, he proceeds to the great experiment of the so-called *separation*, adds a quantity of lime, and thereby transforms a considerable part of the nitrogenous substances, which are of such great value as nutriment, into slime of a gray and muddy appearance ; this last he presses, and perhaps also undertakes some other ingenious performance with it, but by which he still cannot prevent that a part of this sugar remains behind in the pressed silt.

After separation he allows artificially generated carbonic acid to flow into the juice, in this way again making silt and again losing sugar. Hereupon he filtrates the juice for the purpose of further relieving it of the nitrogenous substances, through bone black, thoroughly defiling the latter, causing an additional expense to restore it again, besides again leaving sugar in the sediments.

However, as the filtration with bone black cannot efficiently effect the separation of the juice from the other substances before named, what remains of the latter accompanies the former to the end of the whole process. The juice when boiled down yields in three or four crystalizations, only sugar which is more or less soiled with yellow and brown stains, and to remove these he has to apply the centrifugals, which again occasions a loss of sugar.

Finally, after having for almost an entire year battled with great expense, utmost exertion and bravery, against his mortal enemy, the slime, he must strike his flag because he finds himself confronted with a kind of bird's lime, the so-called molasses, from which there is nothing more to be gained, because it contains the whole residue of the nitrogenous substances, or into whatever they may have been transformed during the process, and being large enough to prevent the crystalization of the still considerable quantity of crystalizable sugar remaining in the molasses, it causes, in this last instance, the incidental loss of the *sixth part of the original* saccharine of the beets.

This just as absurd as extravagant management, and its consequences, the excessive costs of establishing, the loss of one-third of the sugar contained in the beets, and all their nutritious ingredients, etc., are mainly due to the circumstance of having at the beginning started from a false basis, and persistently and delusively clinging to it for the past half century; the first is not surprising, but the latter is highly remarkable.

Thirty-five years ago, in consequence of momentary leisure, and induced by curiosity to meddle with the beet sugar production, I then clearly perceived that the difficulties of the plan then and now in use were mainly caused by the existence of the nitrogenous substances in the juice, and that the manufacturing process should begin with removing these first, in order to make it possible to gain the sugar from the beets without difficulty, and in the cheapest and simplest manner. This conviction and nothing else induced me to discover and introduce the drying process, for only by drying the beets can we without any great expense attain the removal of the cause at the commencement. What induced me to leave this strictly rational way, temporarily, has been explained on page second of this pamphlet.

A few years later I labored with success to improve the manufacture of sugar on the old basis. This was by no means done in consequence of a change of my views in relation to it; they had not, nor could they, undergo a change, as they were based upon substantial facts, it was solely done with the object of diminishing the existing evils as far as possible, which at that time I could not entirely overcome. By my improvements, introduced during the years 1842-3, the beet-root sugar manufacturing interest, which, as well known, was then in an expiring condition, was again revived and strengthened, and it has, particularly in consequence of them, continually extended itself further and further. For this a great part of the public, especially in Germany, looked upon me as an enemy to their common interest, and treated me accordingly. Some of the manufacturers rewarded my services, of which they derived the first advantages, by endeavoring to injure me when and wherever they could, and consequently expect in return for their noble treatment every attention from me, and, in their opinion, suppose that they have a right of demanding it. I, however, take the liberty of viewing it in a different light. Another number of these gentleman, even the greatest part of them, treated my services rendered them with more or less injustice, and some even went so far as to call me, with the kind purpose of honoring and pleasing, the father of beet-root sugar manufactory, of course referring by this to the old process improved by myself. This is an honor I have not deserved, and have no intention of claiming it ; on the contrary, I preserve myself against every suspicion of being the father of this disgusting miscarriage of spiritual genius, which, by causing the destruction of quantities of excellent substances, had occasioned great damage, and given to the factories, erected at great expense, and in part richly fitted up with fine machineries and utensils, the appearance of glue factories, with their interior and surroundings besmeared and filled with filthy and disgusting odors.

It is evident from the inquiries addressed to me to the present time that some of the manufacturers and refiners have strange ideas concerning my new process, and express apprehensions in regard to its application, for which there are no grounds whatever. To speak plainly, some of their fears appear chimerical. Although most every one of these gentlemen has his particular doubts, more or less, but, taking them together, the following make themselves conspicuous :

That the drying and cutting establishment will require a large capital ; the drying will be expensive, and its success dependant upon the weather, and even upon accidents ; it requires a too large supply of alcohol, hardly attainable ; and, in every operation, a considerable portion of it will be lost by evaporation, etc. ; and the sugar retain an alcoholic taste and scent ; the danger of fire is increased by the use of alcohol.

I do not in the least doubt that these apprehensions would be well founded, and would result in the consequences presumed, had I adopted the system which others have eroneously supposed to be mine, but I have not. I proceed on another and newer way, of which they have been entirely ignorant up to the present time, and, therefore, for the very reason of its being an entirely different one, must consequently lead to entirely different results and views. It is to be deplored in the interest of the public that men occupying prominent positions, educated and otherwise respectable, will sometimes on like occasions as the present, seduced by motives not very reputable, act in a silly manner, and talk of things of which they can neither possess nor acquire any knowledge, and therefore lead others to form erroneous convictions and judgments.

Although I have to fear that in repeating what has already been mentioned I may become prolix, I still deem it necessary, in order to remove the doubts expressed to declare in a precise manner the following, viz. :

That the capital required for the erection of an establishment, of proper proportion to the amount of business to be done, for drying and cutting the beets, is not a large sum, and is the only expense, so to speak, which a manufacturer who decides upon the adoption of the new system is obliged to incur in order to transform his factory. I refer to what I have already stated with regard to this matter, The expenses of drying and cutting the beets are included in the total cost of manufacturing, of which I have already stated that, everything included, they are much less than the cost of manufacturing and refining by the old systems. In consequence of the improvements attained recently, it is impossible, without gross neglect, for the crystalizable sugar in the beets to suffer injury during the drying process.

The cut and dried beets can be preserved without the least injury for an indefinite length of time, at any rate for several years, just the same as good raw sugar may be, presupposing, however, that they have been protected against the effects of the air and of dampness, which can easily be done. It is well known that this precaution is also required with the raw sugar for its preservation.

The extraction is a complete one. There remains neither sugar nor alcohol in the pulps.

The loss of alcohol is so very small, owing to the improvements effected in the redistilling apparatus, that it can hardly be taken into account.

Whatever sensible loss may occur in consequence of lack of minute attention, has already been charged in the estimate of the whole cost, taking it at the highest figure.

The supply of alcohol needed can be procured at a moderate cost ; it requires no larger outlay than for the bone-black used in a factory on the old plan.

It is physically impossible that any trace of alcohol or any other odorous substance can remain in the liquid which has arrived at the stage of being boiled down. This results from the treatment to which the extract freed from the alcohol is subjected.

There is in the new manner of producing sugar no trace of any disagreeable smell, much less of any filth to be perceived.

The fibres, the nitrogenous substances, and the salts which combined form the residue of the new process, are separated each by itself and obtained unchanged and undiminished. The well preserved and so excellent nutritious substance for cattle food increase the value of the pulp three-fold compared with that of the old systems. The salts obtained separately are again returned to the soil in which the beets were cultivated. The apprehension of an increased danger from fire owing to the manner in which the alcohol is applied in the new process is a chimera. It is well known that cold alcohol circulating in hermetically closed tanks, will not ignite spontaneously, nor can it escape by evaporation and be absorbed in the air, thereby bringing about an explosion. Therefore the application of this new system will not occasion any fire. Supposing an incendiary fire, the old process is as much exposed to that danger as the new. Whoever still labors under the apprehension of this calamity may build a detached house in which the alcohol process can be carried on, only connecting it with the main factory by a copper pipe for returning the extract, freed from alcohol, to it. I must here mention that there is no occasion to use any fire in this building.

Of the many other apprehensions expressed I take no notice, as they are of no importance, and many of them of so vain a nature that they deserve no reply.

The new system will lead to so complete a revolution in the manufacture und refining of sugar that in future the carrying on of the old process will be rendered impossible. An innovation which so deeply penetrates all agricultural and economical relations, and which is destined to influence the course of the commerce of the whole world cannot proceed without imperilling and angering many existing interests ; this is to be regretted, but cannot be avoided. That those who fear they will suffer injury by such an invention should appear as opponents is not strange. To those adversaries who are naturally hostile and in a manner justified in their opposition many others will join themselves from reprobate, censurable, and sometimes silly motives. It is certainly to be anticipated that the number of its enemies will be great. The cry of—stone him ! will again be raised against me, though an old man of over seventy years, but this cry will not affect me. I have already, from similar causes, often experienced it, and am therefore accustomed to it. It is evident that the advantages which might have accrued to me eventually from the introduction of this innovation, have for me, now standing near the terminus of my life, no more attraction or value.

When I notwithstanding unmoved by the cries of the opposition and hostile and miserable attacks of all kinds still proceed onward, I do it because I am positively convinced that I am performing an important service to humanity.

The hopes which may for a time be entertained by manufacturers and refiners of casting suspicion upon the new process by concert, intrigue, and other dishonorable manœuvres, and thereby detering many persons from adopting it, are very deceptive. Although they may have succeeded in other instances in accomplishing their objects by various ingenuity, they surely will fail this time.

The present matter does not merely concern a few persons who may be blinded by silly arguments and talk made incomprehensible to most people, and only possessing interest to a single class which can be deluded by prominent leaders in the trade ; but on the contrary it concerns a simple, lucid, easily comprehensible, and *accomplished* fact, accessible to every one, which is of the utmost importance, not only for a single country or for a limited number of its inhabitants, but for all countries of the world, and directly for many classes of their people ; and lastly, for their public economy and their governments. It is not to be apprehended that against *facts* of this kind the selfish intrigues of individuals, or even the sage judgment of guild-masters will have any permanent effect. It is a great mistake to suppose that by resorting to all sorts of means, often contemptible ones, an increase of production can be hindered, and inventors deterred from discovering and introducing valuable improvements in any branch of industry whatever ; and that when they do appear public interest and attention can be diverted from them. As long as people perceive that their manufacturing neighbor does a good business they will desire to partake of the same advantages ; they, consequently, will also erect a factory if they can possibly manage to do so. In this manner it will continue until the wares can hardly or not at all be disposed of at its cost price. Until this event arrives in the natural course of things, the increase of production will go on, no matter whether new improvements have during the meantime been introduced or not.

Providentially no two successive crops have turned out poor, which seldom occurs, otherwise such a moment as predicted would have now arrived, and all the factories less favored by circumstances be compelled to stop working.

As matters stand at present, the German sugar manufacturers can only find their salvation in attaining the point of producing their sugar at a great deal cheaper rate than they now do. The cheapening of refined sugar will increase its domestic consumption in proportion to the reduction of price. An additional and still further reaching remedy to prevent the surfeit of the home markets will be in its export consequent upon its cheapness. Although there are important improvements contemplated in the making of cane sugar, still the colonies will never succeed, owing to various and unchangeable circumstances, in producing and bringing to the European markets pure white sugar, without a manifest loss, at the price for which German manufacturers supply the same, with a considerable profit to themselves, that is, if in place of the old they adopt the new system. If they succeed in supplying the world's market with sugar, with gain to the makers, no overstocking of the home market can ever take place, not even if five or ten times as much sugar be produced as is now done ; self-evidently those coming first will derive the largest profits from the invention.

C. S. SCHUZENBACH.

APPENDIX.

The apparatus designed and constructed by Schüzenbach for the conversion of sugar beets and other saccharine plants into crystaline sugar, consists of the following described machines, with the necessary buildings; drawings and models of which are in the possession of his nephew. Constantin Rosswog, patentee for the U. S., and administrator of the estate of Seb stian Schüzenbach, Nos. 9 and 11 Maiden Lane, New York. These are:

1. A house for washing and slicing the beets.
2. Large building fitted up with ovens, or heaters for drying the beets after slicing, and capable of dessicating a hundred tons per diem.
3. Machine for chopping the dried beets into small grains.
4. A sugar factory containing the extracting machinery. The agent employed for this operation is alcohol of a certain strength, and heated to a particular temperature. The alcohol is contained in a receiver from which it is pumped up i to a distributing reservoir. From this it descends into a heater, situated 45 feet below it, and on a level with the extraction battery This is composed of two large tanks, or baths of water, in which are immersed 32 cast-iron cylinders, holding from a cwt. to a ton, or more, of dried beets each, according to the extent of the work to be done. Each jar, or cylinder, is fitted with a coil of pipe in the bottom, for admitting steam; an agitator for stirring the beets; a man-hole on the side for filling and emptying it, and a system of pipes and cocks connecting with the other parts of the machinery. The alcohol enters jar No. 1, with a hydraulic pressure due to the column 45 feet in height, at the bottom, permeates the mass of beet substance, and passes out at the top into the bottom of jar No. 2, fresh alcohol entering jar No. 1, at the same time. This process continues until the alcohol is saturated with sugar, which occurs at about the fifteenth jar, when the first jar has received new alcohol fifteen times. At this point the contents of jar No 15 are drawn off into a cooler whence they descend into a series of crystalizing jars, where the sugar is deposited at the bottom in the form of large, almost colorless, and nearly chemically pure crystals of sugar.

The alcohol is then drawn off and pumped up into a second cooler. It now holds in solution a certain quantity of sugar due to the water, fifteen per cent., which is in alcohol. It now goes by the name of mother water, and is led to a second heater, provided like the first one with a steam pipe as the coolers are with a cold water pipe coiled inside, and again enters the battery at jar No. 1, whence it passes through the other jars successively. The mother water is saturated at the eighth jar, drawn off into a cooler, and thence into the crystallizing jars. The remaining operations consist, in brief, of distillation of the alcohol left in the exhausted pulp, which is done by condensing it with steam, and the vapors pass out into a condenser and thence into a still.

6. Tanks, distilling apparatus, coolers, pumps, etc., the whole system being hermetically closed and connected with pipes and cocks. During the entire process the alcohol is never once exposed to the air, and theoretically there should be no loss—practically there is very little. The salts, albumen, &c., remain in the pulp, and no filth, or gum appears, the sugar house being always as clean as a drawing-room, and affording a complete and astonishing contrast to the disgusting interior of the sugar houses and refineries now in use on the old plan. There are other details which cannot be entered upon here, but will be made clear to those who desire to fully understand the process.

Beets can be raised and prepared for the factory at a cost of less than two cents per pound of pure sugar contained in them; the expense of making them into chemically pure sugar, worth, in the American markets, $270 per ton, will not exceed two cents a pound, probably it will be much less, making the entire cost of production not more than $80 per ton, showing a profit of one hundred and ninety dollars per ton.

These statements are not theoretical ones, but are founded on well known and undeniable facts, which are within the reach of every one.

It should be stated, in conclusion, in order that persons somewhat acquainted with beet sugar manufacture may not be misled, by supposing that the method of Schüzenbach is the old maceration process invented by him, that the present system is of an entirely different nature, although dried beets are used in this plan as in the other. The alcohol process has never been used in Europe, having been perfected in all its details but one year prior to his death. He called together, in his own laboratory, thirty-six of the leading beet sugar manufacturers of France, Holland and Germany, in whose presence the process was fully tried and conducted through all its various stages. The results were eminently satisfactory, establishing all that he had asserted, to the astonishment of the gentlemen invited to witness the experiments, who were of one mind in regarding it a the true principle of sugar making.

He was unwilling to permit the use of his method in Germany until he could receive the gold medal from the Zollverein, and in order to accomplish this he began to build a factory on his new plan on a large scale, but, unfortunately, he had an attack of apoplexy, and could not carry out his intention ; he therefore sent to his nephew. Mr. Constantin Rosswog, residing in America, and entrusted him with his drawings, models, etc., charging him to introduce his invention in the United States, where no opposition would be made to its adoption.

Address,

CONSTANTIN ROSSWOG,
Administrator of C. S. Schüzenbach,
9 & 10 Maiden Lane,
New York

Spiess & Rosswog,

MANUFACTURERS AND IMPORTERS OF

Fine Jewelry and Diamond Goods,

9 & 11 MAIDEN LANE,

NEW YORK.

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